Interface Requirements Document (IRD) between Earth Science Data and Information System (ESDIS) and the NASA Science Internet (NSI) For Non-EOSDIS Core System (Non-ECS) EOSDIS Elements

January 1997

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

This page intentionally left blank.

Interface Requirements Document (IRD) between Earth Science Data and Information System (ESDIS) and the NASA Science Internet (NSI) for Non-EOSDIS Core System (Non-ECS) EOSDIS Elements

Reviewed By:

_____

Richard desJardins   Date
Systems Engineer
GSFC - Code 505

_____

Candace Carlisle   Date
System Interface Manager
GSFC - Code 505

_____

Dawn Lowe   Date
Science Systems Development Manager
GSFC - Code 505

Approved by:

_____

Dan Scott   Date
NISN System Engineer
MSFC

_____

Arthur F. Obenschain   Date
ESDIS Project Manager
GSFC - Code 423

Goddard Space Flight Center
Greenbelt, Maryland

This page intentionally left blank.

Preface

This document is a formal deliverable. It requires Government review and approval prior to acceptance and use. This document is under ESDIS Project Configuration Control.

Any questions should be addressed to:

Configuration Management Office
The ESDIS Project Office
Goddard Space Flight Center
Greenbelt, Md. 20771
Code 505

This page intentionally left blank.

Abstract

This document describes the interface requirements between the NASA Science Internet (NSI) and elements of the Earth Observing System Data and Information System (EOSDIS) which are not part of the EOSDIS Core System (ECS). The Earth Science Data and Information System (ESDIS) Project provides the requirements for EOSDIS External Network connectivity to NSI. In the context of this IRD, a non-ECS EOSDIS External Network requirement is defined as network connectivity needed to support external science community access to EOSDIS data. Network bandwidth requirements are determined by a number of factors including the ESDIS User Model Scenarios and Data Model Analyses.

The non-ECS EOSDIS External Network requirements given to NSI are classified into groups with similar requirements. These categories are:

- Instrument Support Terminal (IST) connectivity, to provide instrument monitoring capabilities.

- Quality Assurance Science Computing Facility (QA SCF) connectivity, to provide quality assurance data to instrument QA investigators.

- Connectivity from the Distributed Active Archive Centers (DAACs) to the Internet, to provide transfer of EOSDIS data and information to general users.

- Basic User Service, to assure that EOS-funded investigators in the US have adequate Internet access to EOSDIS and affiliated facilities.

For each of these four categories of service, this document defines the requirements tasked to NSI by ESDIS, including sites, functional and performance requirements, estimated data volumes, and prioritization of requirements. For the ISTs, QA SCFs, connectivity from the DAACs to the Internet, and most Basic User Service sites, NSI is also required to provide out-of-band access (dialup service) for backup management of the links. Each of the four service categories is discussed in a separate section of this document. The specific engineering approaches which NSI plans to use to implement these requirements as well as the detailed schedules are presented in the NSI-EOS Networking Project Baseline Implementation Plan.

This page intentionally left blank.

Change Record Page

ISSUE	DATE	PAGES AFFECTED	DESCRIPTION
Baseline	1/15/97	All	CCR 505-42-01-005B

This page intentionally left blank.

List of Affected Pages

Page No.	Revision	Page No.	Revision	Page No.	Revision	Page No.	Revision
Title	Original	4-1	Original				
i	Original	4-2	Original				
ii	Original	4-3	Original				
iii	Original	4-4	Original				
iv	Original	4-5	Original				
v	Original	4-6	Original				
vi	Original	4-7	Original				
vii	Original	4-8	Original				
viii	Original	5-1	Original				
ix	Original	5-2	Original				
x	Original	6-1	Original				
xi	Original	6-2	Original				
xii	Original	AB-1	Original				
xiii	Original	AB-2	Original				
xiv	Original						
1-1	Original						
1-2	Original						
2-1	Original						
2-2	Original						
3-1	Original						
3-2	Original						

This page intentionally left blank

Contents

---

1. Introduction

2. Related Documentation

3. Systems Descriptions

4. General Guidelines for NSI Implementation of Requirements

5. Functional and Performance Interface Requirements

6. Interface Control Documentation

Tables

Abbreviations and Acronyms

This page intentionally left blank.

1. Introduction

1.1 Identification

This Interface Requirements Document (IRD) is a required deliverable under the Earth Observing System (EOS) Data and Information System (EOSDIS) tasking to the NASA Science Internet (NSI). It defines the interface requirements between the ESDIS Project and the Earth Science Data and Information System (ESDIS) Project and the NASA Science Internet (NSI).

1.2 Scope

This IRD defines all of the system interfaces that exist between the ESDIS Project and the NSI networks. Any changes in the interface requirements must be agreed to by the relevant participating parties, and then assessed at the ESDIS Project Level. This IRD will be approved under the signature of the ESDIS Project Manager and NSI.

1.3 Purpose and Objectives

This document is written to formalize the interpretation and general understanding of the interface between ESDIS and the NSI. This document provides clarification and elaboration of the ESDIS-NSI interface requirements. It is meant to stand alone as a total document and contains more detail than a Level 3 requirements specification.

The objective of this document is to provide a focus for defining the ESDIS-NSI Interface Control Document (ICD) for the interfaces identified in this IRD.

This document provides a point of mutual control of external interface definitions for the ESDIS CCB.

1.4 Status and Schedule

This document has been approved by the ESDIS CCB as a final IRD. This document requires Government review and approval prior to acceptance and use. At the Government's option, this document may be designated to be under full Government CCB control.

Changes may be submitted for consideration by Government CCBs under the normal change process at any time.

1.5   Document Organization

This Interface Requirements Document is organized as described below:

Section 1   Introduction - Introduces the IRD's scope, purpose, objectives, status, schedule, and document organization.

Section 2   Related Documentation - Provides a bibliography of reference documents for the IRD organized by parent, applicable, and information subsections.

Section 3   Systems Description - Provides an overview of both systems and a discussion of the system components involved in the interface.

Section 4   General Guidelines for NSI Implementation of Requirements - Presents the requirements for each category of NSI service, including sites, technical requirements, and implementation schedules.

Section 5   Functional and Performance Interface Requirements - Provides the references to parent documents and NSI Requirements Traceability information.

Section 6   Interface Control Documentation - Identifies the functional and physical design documentation derived from this document.

Appendix AB   Abbreviations and Acronyms

2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which this document's scope and content derive:

none   NASA Science Internet (NSI) - Earth Observation System (EOS)
                    Networking Project Baselined Implementation Plan, NASA Science
                        Internet, Version 3.0.1, August 1996

none   Dr. Michael King, EOS Directory
                    Database, http://spso.gsfc.nasa.gov/spso_homepage.html

NP-215   1995 MTPE EOS Reference Handbook, EOS Project Science Office:
Point   of Contact: Charlotte Griner, Code 900, NASA/Goddard Space
Flight   Center, Greenbelt Maryland 20771

223-CD-001-002   ECS External Traffic Requirements, 8/96

none   NSI Requirements Database: Updated quarterly

2.2 Applicable Documents

none   Goddard Space Flight Center, Earth Science Data and Information System
                    (ESDIS)-NASA Science Internet (NSI) Inter-Project Agreement, 2/10/94

505-41-17   Interface Requirements Document (IRD) between the Earth Observing
                    System Data and Information System (EOSDIS) Core System (ECS) and
                    the NASA Science Internet (NSI)

2.3 Information Documents

The following documents, although not directly applicable, amplify or clarify the information presented in this document, but are not binding.

NMI 2410.7A   NASA Management Instruction: Assuring the Security and Integrity of
                    NASA Automated Information Resources, 7/8/88

none   National Computer Systems Laboratory (NCSL) Bulletin, Guidance to
                    Federal Agencies on the Use of Trusted Systems Technology, 7/90

DO-SEC1037.0   Network Science Internet, Network Security Archive, Handbook, 8/93

DO-SEC1042.0   Network Science Internet, Introduction to Network Security, 9/93

DO-SEC1043.0   NASA Science Internet, Network Security Basics, A Primer for
                      System Administrators, 8/93

NAS2-3210-648   Network Science Internet, Network Security Information, 9/93

RFC 1600   Internet Official Protocol Standards, 3/94

3. Systems Descriptions

3.1 Systems Relationship Overview

This document describes the interface requirements between the NASA Science Internet (NSI) and elements of the Earth Observing System Data and Information System (EOSDIS) which are not part of the EOSDIS Core System (ECS).   The interface requirements between NSI and elements of EOSDIS which are part of the ECS are described in the ECS-NSI IRD. Both IRDs trace to the overall Inter-Project Agreement (IPA) between the Earth Science Data and Information System (ESDIS) Project Office and the NASA Science Internet - Earth Observing System (NSI-EOS) Networking Project. The ESDIS project office is located at NASA Goddard Space Flight Center, and the NSI-EOS Networking Project (referred to as NSI throughout this document) is located at NASA Ames Research Center.

3.2 Earth Science Data and Information System (ESDIS) Project

ESDIS provides the requirements for EOSDIS External Network connectivity to NSI. In the context of this IRD, an EOSDIS External Network requirement is defined as network connectivity needed to support external science community access to EOSDIS data. Network bandwidth requirements are determined by a number of factors including the ESDIS User Model Scenarios and Data Model Analyses.

This IRD contains detailed descriptions of the services required. However, the detailed listing of sites and their implementation schedule requirements are not directly included; instead, a separate requirements database is maintained by NSI. ECS requirements in this NSI requirements database are also referenced in DID-223, "ECS External Traffic Requirements", maintained by ECS. This NSI requirements database is reviewed quarterly by the ESDIS and Mission to Planet Earth (MTPE) Projects.

3.3 NASA Science Internet (NSI)

The non-ECS EOSDIS External Network requirements given to NSI are classified into groups with similar requirements. These categories are:

- Instrument Support Terminal (IST) connectivity, to provide instrument monitoring capabilities.

- Quality Assurance Science Computing Facility (QA SCF) connectivity, to provide quality assurance data to instrument QA investigators.

- Connectivity from the Distributed Active Archive Centers (DAACs) to the Internet, to provide transfer of EOSDIS data and information to general users.

- Basic User Service, to assure that EOS-funded investigators in the US have adequate Internet access to EOSDIS and affiliated facilities.

For each of these four categories of service, this document defines the requirements tasked to NSI by ESDIS, including sites, functional and performance requirements, estimated data volumes, and prioritization of requirements. For the ISTs, QA SCFs, connectivity from the DAACs to the Internet, and most Basic User Service sites, NSI is also required to provide out-of-band access (dialup service) for backup management of the links.

Each of the four service categories is discussed in a separate section of this document. The specific engineering approaches which NSI plans to use to implement these requirements as well as the detailed schedules are presented in the NSI-EOS Networking Project Baseline Implementation Plan.

4. General Guidelines for NSI Implementation of Requirements

4.1 Assumptions

NSI implementation of ESDIS requirements is based on the following assumptions:

- Schedules for implementation of circuits are based on launch dates, the amount of time required for testing of the circuits prior to launch, priority of the requirement, and the amount of time estimated to implement and test a link. The detailed schedules are given in the Implementation Plan.

- ESDIS requirements to meet the four categories of services will require upgrades to the NSI backbone service. The NSI-EOS Project will identify these required upgrades and forward them to the NSI backbone engineering group for inclusion in the NSI overall backbone requirements. It is assumed that the backbone will be upgraded as needed to support these requirements, with ESDIS providing the needed incremental funding.

- NSI is required to consider alternative and new technologies, e.g. SMDS, ISDN, FNS where they are available, technically feasible and cost-effective.

- ESDIS estimates of data volumes, data flows and user services are evolving, resulting in changes to ESDIS external network requirements. NSI will respond to these changing requirements. The data volume requirements to which the NSI responds are maintained in DID 223 for ECS related requirements and are provided by the ESDIS and MTPE Projects at Quarterly Requirements Reviews for non-ECS related requirements.

The NSI is required to manage its own network services; this is accomplished at the NSI Network Operations Center (NOC). The NOC is tasked to provide emergency assistance for network security problems and to provide resolution of wide area network problems through a hierarchical interaction with other network service providers. The NSI NOC will troubleshoot all areas of the NSI network and will coordinate service and operational issues with other network operation centers managed by other agencies and international entities.

Details regarding the NSI NOC interface to ECS are described in the ECS-NSI ICD. For non-ECS elements, NSI NOC provides its standard user interfaces via toll-free 800 telephone service and email.

4.2 Scope of NSI Activities

For each of the four categories of requirements, NSI will provide personnel and services to analyze and support the requirements, including the following activities:

- A site specific analysis of each site to determine its detailed requirements.

- For each ESDIS required site, NSI will analyze alternative services available to that site. NSI recommendations for service to each site will consider alternative services from Commercial Internet Service Providers (CISPs) where they are available, technologically feasible, and cost-effective.

- NSI will provide ESDIS with a detailed cost analysis for each alternative approach for meeting each ESDIS requirement.

- For each ESDIS-approved site implementation, NSI will develop an implementation plan and schedule, and execute the approved plan.

- NSI will provide compliance monitoring of external network service:

    - For service provided directly by NSI, the NSI Network Operations Center (NOC) provides 24 hour per day, 7 days per week monitoring of all circuits. Any problems that users have with NSI services should be reported directly to the NSI NOC for resolution.

    - For ESDIS-procured service provided by CISPs, it is the CISP responsibility to ensure continued compliance. NSI cannot monitor or maintain services provided by other vendors. However, should an EOS user feel that their CISP service is inadequate, NSI will make every attempt to work with the CISP to resolve the problem.

    - Due to the large number of Basic User Service users, NSI cannot provide continuous monitoring of compliance for each site. NSI will rely on the end-users or the campus network providers to inform the NSI NOC if they feel they are not receiving adequate service.

- For NSI provisioned services, the NSI NOC will issue Quarterly Reports to ESDIS Project Management. These reports will provide link utilization information. In addition, NSI Operations will make the following information available to ESDIS Project Management:

    1. Status of all EOS related open trouble tickets.

    2. Utilization levels of specific links.

3. Summary reports of all EOS related trouble tickets.

4. Summary reports of link availability for specific links.

4.3 Requirements

4.3.1 Instrument Support Terminal (IST) Requirements

ESDIS has tasked responsibility for IST requirements to NSI. In its decision memo of November 1995, ESDIS stated that "ISTs are science user workstations and should be connected through NSI instead of through EBnet. However, the AM-1 IST at Valley Forge and the ASTER ISTs are exceptions which will be connected through EBnet."

NSI will make every effort to meet the requirements specified by the ESDIS Project for ISTs. However, since NSI is not a real-time network, there can be no guarantee that the performance requirements stated below can be met. NSI will approach the ISTs on a best-effort basis, and will work with the ESDIS Project and the flight projects to resolve any difficulties.

4.3.1.1 IST Sites

ISTs consist of user workstations running specific software products. The purpose of the ISTs is to provide instrument scientists with the ability to model, configure, test, and support mission instruments. Since these activities impose more stringent access needs than the Basic User Service access requirements, the engineering of these requirements is more complex.
For the AM-1 Mission, ESDIS has identified the IST sites as given in the following table. The AM-1 IST at Valley Forge is not an NSI requirement

INSTRUMENT	SITE	#ISTs
CERES	LaRC	6
MISR	JPL	3
MODIS	GSFC	3
MOPITT[1]	NCAR	1
MOPITT	Toronto	1
ASTER[2]	Japan	2
ASTER[3]	JPL	1

Table 4.3.1.1-1

---

[1] NCAR MOPITT IST requirements are not full IST requirements.
[2] Network requirements for ASTER ISTs are not an NSI requirement at this time.
[3] Network requirements for ASTER ISTs are not an NSI requirement at this time.

4.3.1.2 IST Performance Requirements

All IST traffic is between an individual IST and the EOSDIS Operations Center (EOC) at GSFC, except for the ASTER ISTs which are not NSI requirements. There are three functions that will be performed by the ISTs with the EOC over the network:

1. File transfers of various data for analysis.
2. Issuance of interactive commands.
3. Real time instrument monitoring.

For file transfers, the nominal file size is 7 MB (megabytes), with a maximum of 4 such files transferred each hour. The performance requirement is defined in terms of the length of time needed by the network to transfer each file, including all network and protocol overhead.

For interactive commands, short blocks of data are sent from the ISTs to the EOC, and somewhat longer responses are returned. The performance requirement is the round-trip delay time (latency) contributed by the network, including all network overhead factors but excluding server response time.

Real time instrument monitoring requires a constant 16 Kbps real-time telemetry data stream to be sent from the EOC to the ISTs. For this data stream to be effective, limits must be met for the *inter-packet latency* and the *packet latency jitter.* The requirement for inter-packet latency within the network is defined in the previous paragraph as the round trip delay time for interactive commands. *Packet latency jitter* is the variation of inter-packet latencies seen over time. The requirements for limiting packet latency jitter are given in the following table.

Function	Parameter	50%	90%	99%
File Transfer (7MB)	Transfer time	3 min	4 min	8 min
Interactive commands	Round trip time	500 ms	1 sec	2 sec
Real time	Latency jitter	1 sec	2 sec	4 sec

Table 4.3.1.2-1

The above table details the performance requirements for these parameters, which are required to be met 50%, 90% and 99% of the time. It is assumed that all ISTs at an individual site may be operating simultaneously and may even be performing the same function simultaneously. The IST requirements apply 24 hours per day, including during prime shift operations. The stated requirements must be met at every time that the NSI IST service is available during any 24 hour daily period.

The reliability/maintainability/availability (RMA) requirements for network support of the ISTs are as follows:

- Operational availability: 0.96 minimum
- Mean time to restore: 4 hours maximum

4.3.1.3 IST Implementation Schedule Requirements

The ESDIS Project need date for ISTs is defined by the Launch date for the missions the ISTs support (ESDIS has determined that current connectivity of IST sites is adequate for prelaunch testing). In the case of the AM-1 mission instruments, the launch date is June 1998. NSI is currently scheduled to provide operational capability of the IST circuits by May 1998.

4.3.2 Quality Assurance Science Computation Facility (QA SCF) Requirements

The ESDIS Project has tasked NSI to assure sufficient network capacity to meet the specified data delivery requirements to each QA SCF. Data volumes to support the QA SCFs have been set by the Instrument teams. These data flow requirements are given in the following table.

Site	AM-1 Instrument	Archive DAAC	QA Site	QA GB/D	QA Mbps W/OH
1	ASTER	EDC	JPL (TBD)	1.83	0.39
2	CERES	LaRC	LaRC	92.7	20.0
3			Boulder	.09	0.02
4			SUNY	0.32	0.07
5			Oregon State	23.5	5.07
6			Ecole Poly.	0.04	0.01
7			GSFC	2.5	0.54
8			U Wisconsin	17,8	3.77
9			NOAA NWS	0.017	0.01
10			Scripps Inst.	0.37	0.08
11			Colo. St. U.	3.84	083
12			SD Sch. Mines	50.0	10.79
13	MISR	LaRC	JPL	60.5	13.07
14			London	1.06	0.23
15			Arizona	1.30	0.28
16			PSU	0.09	0.02
17			LANL	1.06	0.23
18			GSFC	0.09	0.02
19			Miami	0.09	0.02
20	MODIS	GSFC	GSFC	213.1	46.05
21			Miami	40.5	8.74
22			U Wisconsin	5.51	1.19
23			Oregon State	3.66	0.79
24			UCSB	3.29	0.71
25		EDC	GSFC	9.03	1.95
26			CRSA	6.25	1.35
27			UCSB	2.18	0.47
28			U Montana	1.30	0.28
29		NSIDC	GSFC	6.62	1.43
30		JPL, LaRC	Oregon St. U.	0.09	0.02
31	MOPITT	LaRC et al	NCAR	2.0	0.43
32			Toronto	1.67	0.36
33		EDC	NCAR	0.14	0.03
34		GSFC	NCAR	1.57	0.34

Note: All QA SCFs have an NSI Implementation date of May1998

Table 4.3.2-1

In general, it is expected that the existing connectivity of many of the QA SCF sites will be sufficient to meet the stated ESDIS requirements. However, NSI will analyze each site in detail to assure that the current connectivity of these sites does meet the ESDIS requirements. QA SCF sites requiring upgrading and new service will be analyzed in detail by NSI on a site-by-site basis to determine the appropriate engineering and cost solutions for the requirement.

The ESDIS Project need date for QA SCFs is defined by the launch date. In the case of the AM-1 mission instruments, the launch date is June 1998. The corresponding need date for the QA SCFs is therefore May 1998, which is the date NSI is currently scheduled to provide operational capability of the QA SCF circuits. NSI will provide general connectivity from the DAACs to the Internet at the time the DAACs become operational, so that QA SCF sites can do functional testing prior to the launch readiness date of April 1998.

4.3.3 Data Flow from the DAACs to the Internet

Users are expected to order and retrieve significant amounts of Earth observation data from the EOSDIS DAACs through the Internet. ESDIS has tasked NSI with the requirement to assure the needed network capability.

4.3.3.1 DAAC-to-Internet Data Flow Requirements

ESDIS has tasked NSI to provide data flow capacity from each DAAC to the Internet equivalent to 1X data production volume of that DAAC (This includes the previously stated QA SCF flows). The EOSDIS Ad Hoc Working Group on Production (AHWGP) provides the official estimates of data production volumes at each DAAC. These estimates, which are documented in DID 223, provide the general data volume requirements for delivery of data and information from each DAAC to the Internet.

ESDIS has defined the need date for Release-B DAACs to Internet connectivity as the AM-1 launch date, June, 1998. NSI will complete installation of these links and begin monitoring of the circuits by the NSI Networks Operations Center (NOC) on a 24X7 basis by May 1998.

4.3.3.2 DAAC-to-Internet Compliance Monitoring

The NSI-EOS Project will work with ESDIS to develop appropriate testing procedures and mechanisms for the DAAC-to-Internet links.

4.3.4 Basic User Service Requirements

The ESDIS Project has defined Basic User Service as providing each approved EOSDIS science user with access to a nominal 100 kilobits per second (Kbps) of usable bandwidth.

The required sites for Basic User Service are documented in the Implementation Plan.

NSI is required to perform a site specific analysis for each Basic User Service site. If the user has existing connectivity, NSI will determine if the existing connectivity is sufficient to meet the EOSDIS requirements for the site. If the existing service is determined to be adequate, NSI will report this conclusion back to the EOSDIS Network Manager for concurrence.

If connectivity is provided by a non-NSI service provider, but is not sufficient to meet the requirements, NSI may recommend to the EOSDIS Network Manager that a funding mechanism be identified for the researcher to upgrade the existing service provider's link. If this is not possible or practical, then NSI will work with the campus network organization to provide an NSI connection.

If no other alternative is available or cost effective, NSI will establish nominal T1 service to the user's site or will recommend alternative service approaches (e.g. FNS, SMDS, ISDN) for implementation by ESDIS Project resources.

The Implementation Plan schedules the implementation of EOS requirements based upon the following priority factors:

1. Service to key scientists and facilities.

2. Instrument launch date (schedule).

3. Science team member need date (established by the team leader).

4. NSI implementation pragmatics:
    - Providing new access has priority over upgrading existing access.
    - Upgrading lower quality service has priority over upgrading higher quality service.
    - Providing access for a greater number of researchers has priority over providing access for a smaller number of researchers.

NSI will connect each EOSDIS researcher to the EOSDIS External Network at least *one month* prior to the determined need date to accommodate testing requirements.

No specific EOS security requirements are defined for these Basic User sites.

5. Functional and Performance Interface Requirements

5.1 Requirements Traceability

The functional and performance interface requirements identified in this document will be traced to the following parent documents:

a. EOSDIS Core System (ECS) Requirements Specification

b. Earth Science Data and Information System (ESDIS) Project—Level 2 Requirements

c. ESDIS-NSI Inter-Project Agreement

Refer to Section 5.2 and Appendix A of EOSDIS-NSI IRD (505-41-17) for ECS related NSI Functional and Performance Interface requirements and their Traceability to parent documents identified in this section.

This page intentionally left blank.

6. Interface Control Documentation

The functional and physical design of the interface between ESDIS and NSI, derived from this IRD, is documented in the NASA Internet (NI) Earth Observing System (EOS) Networking Project Plan, published September, 1996 by the NI EOS Project at Ames Research Center. This plan defines the functional and physical design of the interface between ESDIS and the NI, and includes the precise configuration of each interface. The Networking Project Plan is reviewed quarterly by the ESDIS Project and the NI EOS Project to assure configuration control.

This page intentionally left blank.

Abbreviations and Acronyms

AHWGP	Ad Hoc Working Group on Production
ARC	Ames Research Center
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
ATM	Asynchronous Transfer Mode
CERES	Clouds and the Earth's Radiant Energy System
CISP	Commercial Internet Service Provider
CNE	Campus Network Environment
DAAC	Distributed Active Archive Center
EDC	EROS Data Center (Sioux Falls, SD)
EN	External Network
EDMA	ESDIS Data Model Analysis
ESDIS	EOS Data Information System
EOC	EOSDIS Operations Center
EOSDIS	Earth Observing System Data Information System
EUMS	ESDIS User Model Scenario
FNS	Fiber Network Services
Gbps	Giga-bits per second
GSFC	Goddard Space Flight Center
ISDN	Integrated Services Digital Network
IST	Instrument Support Terminal
JPL	Jet Propulsion Laboratory
kbps	kilo-bits per second
LAN	Local Area Network
LaRC	Langley Research Center
MB	Mega-byte
MODIS	Moderate-Resolution Imaging Spectroradiometer
MOPITT	Measurements of Pollution in The Troposphere
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NIC	NASA Information Center
NOC	Network Operations Center
NSI	NASA Science Internet
PSCN	Program Support Communications Network
QA SCF	Quality Assurance Science Computing Facility
RFS	Request for Service
RMA	Reliability/Maintainability/Availability
SMDS	Switched Multimegabit Data Service
TRMM	Tropical Rainfall Measurement Mission

This page intentionally left blank.